

ABSTRACT

This dissertation is about the synthesis and catalytic application of different nanoparticles (Sn/ZnO, Si/Fe₂O₃, Zn/SiO₂, Fe/TiO₂, Sn/TiO₂) by using different methods and the relationship between the parameters, structural and physical properties of nanoparticles.

Various types of transition metals nanoparticles (Sn/ZnO, Si/Fe₂O₃, Fe/TiO₂, Sn/TiO₂) were prepared by using different methods and metal precursors. All types of transition metal nanoparticles (Sn/ZnO, Si/Fe₂O₃, Fe/TiO₂, Sn/TiO₂) were synthesized in solvent controlled manners by using tartaric acid as a stabilizing agent. To study the effect of concentration and solvent on the particle size of nanoparticles, all others parameters of reactions were kept constant i.e., time, temperature, deposition material. The particle size decreases with the increase in concentration of the metal precursors up to critical micelle concentration (CMC). Different solvents have magic effect on the particle size of nanoparticles. Optimization of the growth parameters for the synthesis of nanoparticles were carried out by various methods and by using various solvents such as 2-propanol n-Hexane Acetonitrile and isoamyl alcohol. It was concluded that n-Hexane has unique properties and nanoparticles obtained from this solvent are small in size as compared to other solvents.

Prepared nanoparticles such as (Sn/TiO₂, Fe/TiO₂) were applied as noncatalyst under UV and visible light for the degradation of dye methylene blue (MB), which is environmental hazardous material. The rate constant 'k' for Sn/TiO₂ nanoparticles after 2 hours degradation in UV light is 0.091 and % degradation is 25.925 in the same way 'k' for Fe/TiO₂ nanoparticles is 0.093 and % degradation is 26.914. It means Fe/TiO₂ nanoparticles shows good photocatalytic activities as compared to other synthesized nanoparticles. In the same way Antimicrobial activity of Sn/ZnO nanoparticles was carried out against *Escherichia Coli* (E Coli and *pasteurellamultocida*).

Antimicrobial and Antifungal studies were carried out by using (Si/Fe₂O₃, Zn/SiO₂) nanoparticles against *Candida Parapsilosis* and *Aspergillus niger*, *B. subtilis* and *E. Coli*. In the same way antioxidant application of Fe/TiO₂ nanoparticles synthesized by using different solvents were studied. Highest inhibition was shown against gram negative bacteria by n-Hexane followed by Acetonitrile. The nanoparticles synthesized in

2-Propanol showed the lowest inhibition. The prepared nanoparticles were characterized by Fourier transmission infrared spectroscopy (FTIR), Raman Spectroscopy, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), X-ray Diffraction (XRD), Zeta analyzer, Atomic Force Microscopy (AFM), Photoluminescence Spectroscopy (PL), Thermogravimetric Analysis (TGA), FTIR peaks gives the structure elucidation of nanoparticles. SEM, TEM gives the morphology and particle size of nanoparticles, XRD also assured the product formation and gives the crystallite size, TGA tells about the weight % loss with the change in temperature.